

REMARKS

By this reply, withdrawn claims 14-16, 18, 20-25, 29 and 30 are cancelled without prejudice to or disclaimer of the subject matter contained therein, leaving claims 1-5, 7-13 and 26-28 pending in the application. Reconsideration and allowance of the application are respectfully requested in light of the following remarks.

Rejections Under 35 U.S.C. § 103

A. Claims 1, 4, 5, 7-9 and 11-13 were rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 4,024,617 to McCormick ("McCormick") in view of U.S. Patent No. 3,066,042 to Ogden ("Ogden"), JP 2000-017418 ("JP '418") and U.S. Patent No. 3,617,349 to Prasse ("Prasse"). The reasons for the rejection are stated on pages 3-6 of the Office Action. The rejection is respectfully traversed.

Claim 1 recites a method of applying a wear resistant coating material to a surface (22) of a piston ring (1). The claimed method comprises applying the coating material by a thermal spray process, heat treating the coating material at an elevated temperature and for a time effective to at least partially diffuse the coating material into the underlying surface, by exposing the material to heating temperature below the melting point of the coating material, and applying additional coating material layers (24) subject to successive heat treatments of each applied coating material layer (24) in order to lay down on the piston ring surface (22) a plurality of layers (24) of same coating material. The resulting piston ring coating including the plurality of applied layers (24) has a porosity of between 1 to 15 vol%.

The Office Action acknowledges that McCormick does not disclose various features of claim 1, including forming a coating on a surface of a piston ring by applying multiple layers with a heating diffusion treatment after each layer is applied, and the recited porosity of the applied layers.

However, the Office Action asserts that it would have been obvious to modify McCormick to apply multiple layers of coating with a heating diffusion treatment after each layer is applied, in view of Ogden, and that it would have been obvious to modify McCormick in view of Ogen based on Prasse to optimize the porosity through the diffusion heat treatment. Applicant respectfully disagrees.

McCormick discloses a method of applying a refractory coating to a metal substrate. McCormick discloses a method for producing piston seals with a diffusion-bonded outer coating. McCormick does not disclose applying more than one layer of the same material onto the substrate with a heating diffusion treatment after each layer is applied, or that the applied layer has any particular porosity.

McCormick discloses that the piston seals can have more than one layer. However, in piston seals, the diffusing element is applied as an intermediate coating layer, coating or facing, and a refractory coating is applied over the intermediate coating. See column 4, line 65 to column 5, line 22, of McCormick. McCormick further discloses that "[p]iston seal facings containing a diffusing material may have their bonds improved by use of an intermediate layer which may be diffused into the facing and substrate" (column 8, lines 29-32). Accordingly, McCormick discloses that the multi-layer coatings include layers of different materials to provide improved bonds. Applicant submits that this disclosure would have led one having ordinary

skill in the art away from the claimed method, which comprises applying a plurality of layers of the same material onto the piston ring surface.

Ogden's method comprises the steps of applying a coating layer to a substrate, shot peening the coating layer, heat treating the coating layer to thereby eliminate pores in the coating, and repeating these steps for additional layers to form a multi-layered coating. Ogden does not disclose or suggest applying a coating to a piston ring surface. As such, Ogden does not suggest that the multiple-layer (non-porous) coating would be suitable for a piston ring. Thus, Ogden does not suggest modifying McCormick's single-layer coating to result in the claimed piston ring coating including multiple layers and having a porosity of between 1 to 15 vol%, but teaches away from forming a porous coating layer.

JP '418 discloses a method of applying a coating layer on the bearing face of a bearing base material. JP '418 does not suggest a method that comprises applying a coating including a plurality of layers of the same coating material, much less with a heating diffusion treatment performed after each layer is applied, and the recited porosity of the applied plurality of layers.

Prasse fails to cure the deficiencies of McCormick, Ogden and JP '418 with respect to the claimed subject matter. Prasse also would not have suggested modifying McCormick to produce the claimed resulting multi-layered coating with the recited porosity after heat treatment. Prasse does not disclose or suggest forming a coating with multiple layers that has the claimed porosity after having been heat treated.

Accordingly, none of the applied references suggests coating any substrate, much less a piston ring, with a wear resistant coating including a plurality of layers of

the same coating material, where the resulting coating including the plurality of applied layers has the claimed porosity. McCormick would have led one skilled in the art away from forming a coating having multiple layers of the same material on a substrate. Ogden would have led one skilled in the art away from a coating process that would produce a multiple-layer structure with porosity. JP '418 and Prasse also fail to suggest forming a coating of multiple layers of the same material. Accordingly, the applied references do not suggest a wear resistant coating including a plurality of layers of the same coating material, and where the resulting coating including the plurality of applied layers has the claimed porosity. Thus, the applied references do not suggest modifying McCormick to result in the method recited in claim 1.

In addition to the above-discussed deficiencies of the applied references, Applicant further submits that one skilled in the art of piston rings would normally not have looked to the bearing layer technology. The environment of piston rings has a high degree of sulfur and is acidous. Also, the temperature is high and the lubrication is normally regarded as insufficient for the environment. In contrast, for shaft bearings, the temperature is considered normal, the lubrication is normally sufficient or in excess, and typically the environment is not acidous. For these additional reasons, Applicant submits that one skilled in the art of piston rings and seeking to improve the properties of such piston rings would not have looked to a technical field with such drastically different conditions to take into account.

Thus, because none of the applied references discloses or suggests features of the method recited in claim 1, even if the references were combined despite there being no motivation or suggestion for the proposed combination, the applied teachings of the references still would not result in the claimed method. Thus, the

Office Action has not established *prima facie* obviousness. See M.P.E.P. § 2143.03.

Therefore, claim 1 is patentable.

Claims 4, 5, 7-9 and 11-13, which depend from claim 1, are also patentable for at least the same reasons as those for which claim 1 is patentable. Therefore, withdrawal of the rejection is respectfully requested.

B. Claims 2, 3, 10 and 26-28 were rejected under 35 U.S.C. § 103(a) over McCormick in view of Ogden, JP '418 and Prasse, and further in view of U.S. Patent No. 5,713,129 to Rastegar et al. ("Rastegar"). The reasons for the rejection are stated on pages 7-8 of the Office Action. The rejection is respectfully traversed.

Rastegar has been applied in the Office Action for allegedly disclosing the rotation of piston rings while spraying molten material on the piston rings. Applicant submits that Rastegar does not cure the above-discussed deficiencies of the other applied references with respect to the method recited in claim 1. Accordingly, claims 2, 3, 10 and 26-28, which depend from claim 1, are patentable over the applied combination of references. Therefore, withdrawal of the rejection is respectfully requested.

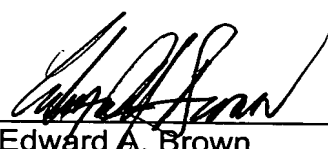
Conclusion

For the foregoing reasons, allowance of the application is respectfully requested. If there are any questions concerning this response, the Examiner is respectfully requested to contact the undersigned at the number given below.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

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By: 
Edward A. Brown
Registration No. 35,033

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620